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A critical analysis of swine medicine in American veterinary schools

Lennart Backstrom, DVM, PhD

Currently, the content and direction of curricula and postgraduate training at veterinary schools in the United States are being reviewed, and changes are being discussed on local and national levels.[1,a] Food animal veterinarians probably have more reasons than any other group to welcome and participate in these discussions. Despite their opinion that there is a great need for veterinary services to the changing livestock industry, food animal veterinary practices do not attract as many young veterinarians as they used to. For many years, most veterinary school graduates have turned to companion and sports animal sectors, and veterinary schools have responded by increasing the number of companion animal clinical faculty and by developing increasingly sophisticated clinical facilities and course programs oriented to the care of the individual and companion animal, with less emphasis on flock and herd food animal medicine. Food animal faculty often believe school resources are too limited to adjust curricula to the needs of the livestock industry, but so far there has been no united opinion among them on how to address the issue.

Who is to blame?

Calvin Schwabe recently addressed the current crisis in food animal veterinary medicine by pointing out that of a recent graduating class at the University of California-Davis, only 2 of 128 went into food animal practice in the livestock intensive state of California. "Something is wrong, and we in the academic veterinary medicine today bear substantial blame."[2] In the swine industry, producers often charge veterinarians with a lack of interest and skills. In a nationwide survey, Wise[3] estimated that 43% of the swine producers in the United States never consult veterinarians. A recent editorial in *Pork '88*[4] indicated an increase of swine producer interest in veterinary services, but at the same time many practitioners with considerable interest and expertise in swine medicine report that swine veterinary practice is unrewarding, primarily because producers have little or no interest in their services. The recent "Prudent Drug Use"[5] program, cosponsored by the American Association of Swine Practitioners (AASP) and National Pork Producers Council (NPPC), so far, appears to have elicited little response from swine producers. The program recommends that swine producers establish a client-veterinarian relationship for monitoring and control of drug residues.[6]

If swine medicine is going to survive as a career emphasis, the cause-effect relationship between producers and veterinarians has to be analyzed. The correct conclusions have to be made, by the producers concerning the use of veterinarians, and by the veterinary schools concerning the quantity and quality of the undergraduate and veterinary school curriculum and the postgraduate training in swine medicine.

Influences on choice of professional field

It is assumed that veterinary students choose their professional field on the basis of a combination of factors, including interest, availability of faculty, courses and other school resources related to various fields of veterinary medicine, the quality of education, educational costs, and job opportunities.

During veterinary school, some students maintain a strong determination to pursue a certain type of career, but many change their minds under the influence of the curriculum and opportunities for specialty training. Thus, the direction and content of courses offered can have a decisive impact on a student's eventual field of choice. A diversified core curriculum might initiate interest in fields not previously considered by the student, whereas a dominance of certain disciplines or animal species might lead to greater depth of knowledge in those areas at the expense of diversity.

When evaluating students' choices of career, educational costs also have to be addressed. It is not surprising that recent graduates, many with accumulated debts of $50,000 or more after 8 years of college studies, are likely to go into the area for which they have been best trained and will be best

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[a]Hall L. Educational strategy and curricular development in veterinary medicine for the 21st century. Purdue University, West Lafayette, Ind, 1988.

paid. This will be even more important as tuition costs continue to increase.

Focus on postgraduate training

So far, discussions about swine medicine as a worthwhile career have been restricted to a small group of consulting and practicing veterinarians[7,8] and producers, who have focused more on postgraduate training,[8,9] continuing education,[9,10] and board recognition[11] than on the quantity and quality of swine topics taught in the veterinary schools. Some of these people seem to believe that no more than 5 to 10 new swine veterinarians will be needed each year to fill the needs of the entire US swine industry (about 85 million hogs produced/year), a trend similar to that which has taken place in the poultry industry. It has been suggested that only one veterinary school be selected to educate those students interested in a career in swine medicine. If that were to occur, swine would gradually disappear from the list of species now included in the practices of most mixed food animal practitioners.[3] Of 9,624 veterinarians recently interviewed, 83.5% were classified as mixed food animal practitioners.[3]

Effect of early specialization in the veterinary curriculum

What will happen to the availability of mixed animal practitioners if a plan such as that proposed by the Purdue University School of Veterinary Medicine,[a] is implemented? That plan calls for combining and shortening the preveterinary and basic sciences portions of the veterinary curriculum to 4 years, followed by 2 years of specialization, with licensure limited to the field in which the student specialized during the 3rd and 4th years. Certainly, this would initiate a radical change in most of the multi-veterinarian mixed practices that have developed successfully over the past decades. Many of these practices use partial subdivisions into specialities when one species, frequently swine, constitutes only a minor part of the practice income. Practitioners within the practice group might develop specific areas and species of interest, but still maintain enough professional diversity and basic skills to provide back-up emergency services, and services for colleagues away for vacations or continuing education courses. The mixed practice also provides financial diversity that will balance losses caused by temporary or permanent decline of one species in a geographic area.

The idea of a basic curriculum leading to a general veterinary degree, with limited elective courses available during the 4th year, has worked well and should not be changed unless proven wrong.[12] The justification for specialization because of the "information explosion" has also been challenged.[13] According to White,[13] the amount of basic information needed for any area of interest is less than overwhelming, and an unexamined belief in the information explosion can lead to radical and costly suggestions for curricular reform, including early specialization in veterinary colleges, and curricula based primarily on information management techniques.

State- and industry-supported herd health programs

When I came to the United States and the University of Illinois in 1979, I was surprised at what I viewed as a bias for companion animal medicine (including equine) in the clinical curriculum. After speaking to other western European food animal veterinarians visiting this country, I know that my reactions were shared by them; how could veterinary colleges in the agricultural heartland of the midwest allow small animal and equine medicine and surgery to dominate so much of the curriculum, compared with the traditional food animal and public health training that is considered so important in Europe? After more than 5 years at the University of Illinois and 4 years at the University of Wisconsin-Madison, I realize that the issues and answers are more complex than I first thought.

Some reasons for the differences between the United States and Europe are obvious. In the open market system of the United States, with decreasing state and federal support to higher education, and increasing tuition costs and demands on income from teaching hospitals and other sources, veterinary clincal education has gradually turned to areas of greatest economic return for the schools and their graduates; companion animal and equine medicine. In most western European countries, the university systems are state-funded and students admitted to the professional program do not pay their tuition and other school costs. With this system, studies are free, but the direction of curriculum is influenced by state authorities and the general public (taxpayers), who relate veterinary medicine not only to the well being of animals but also, and equally important, to the needs of the general public in terms of food production and food safety.

Coming to Illinois from Sweden, where for more than 30 years there has been a nationally organized state- and industry-supported swine herd health program in which 25 field veterinarians are employed for an annual production of 4 million hogs, I was surprised to find little state-organized herd health effort in a state producing almost 12 million hogs/year. A comparison with other livestock industries revealed similar discrepancies. In addition to a state-supported system of mixed practices, Sweden has a national dairy herd health program (predominantly mastitis) similar to its swine program. All similar efforts in Illinois and Wisconsin appear to be initiated by and limited to individual veterinary practices. Sweden has more than 15 state and regional veterinary diagnostic laboratories, whereas Illinois has only 4 and Wisconsin has only 2 state laboratories for a livestock population several times the size of Sweden's.

Statewide herd health programs and diagnostic laboratories are not necessarily superior to independent programs performed by herd owners, practitioners, or companies; however, if well organized and well staffed, the programs provide tremendous opportunities for monitoring and controlling disease and production trends for large areas (computerized records on production results and disease statistics were introduced in Sweden 20 years ago). With diagnostic laboratories within close range, fast and effective services can be provided, and together they stand as a symbol of status and strength of food animal and diagnostic veterinary medicine.

Students' attitudes toward swine medicine in the core curriculum

To me, the strength of any program in veterinary medicine begins with the strength of its professional school education. During 1980 at the University of Illinois, 21 (9%) of 230 class hours for instruction in noninfectious and infectious diseases were devoted to swine, 106 (46%) for small animals, 58 (25%) for bovine species, 39 (17%) for horses, and 7 (3%) for exotic animals. In addition, about 30 class hours were required for avian diseases. The clinical core rotations were even less oriented to swine medicine. In 1981, I conducted a survey of students' interests and attitudes toward these courses. Of a class of 85 senior students, 68 responded with comments on the balance of lecture hours between species. They were also asked to indicate their own main species interest or preferred type. Only 17 students (25%) believed that the distribution between species was "quite fair," whereas 38 (56%) expressed concerns that the course distribution was "unfair" to "extremely unfair" to food animals, in particular swine. Interestingly, no more than 11 of 24 students with a strong interest in small animals stated that the distribution was correct or fair, whereas 7 students stated that the distribution of class hours was "probably not fair," and 7 believed that the curriculum was "unfair" to food animals. Among 10 students expressing a strong interest in "mixed practice," only 3 agreed that the time distribution between species was balanced. Two of 10 students with "strictly bovine practice" interest, and none of 17 students expressing "food animal/swine practice" interest, agreed that the distribution was balanced.

Veterinary curricula in North America vs Europe

As a result of the student survey at the University of Illinois, I was assigned a few more lecture hours for swine medicine (up to 24 hours, 12% of the total number of lectures in these courses). At University of Wisconsin-Madison School of Veterinary Medicine, similar arguments elicited departmental support for an increase in the number of required swine medicine lectures from 8 hours (4% of the total medicine lectures) in 1985–1986, to 17 hours (10%) in 1987–1988.

How does this compare with other veterinary schools in the United States and in other countries where swine production is important? Over the past year, I have gathered information about the required and elective course time assigned to swine health and production in several schools in the United States and one in Canada (Guelph; Table 1) as well as schools in Sweden (Uppsala), Norway (Oslo), Finland (Helsinki), Denmark (Copenhagen), West Germany (Giessen), the Netherlands (Utrecht), and Switzerland (Bern).

Because of different course names, content, and placement in the curriculum, not only between countries but also between schools in the United States, it proved difficult to compare the time and effort assigned to swine. In addition, European veterinary education lasts 5 to 6 years, with no preveterinary requirements. For those reasons, only estimates could be made of the time assigned to teaching medicine, surgery, theriogenology, preventive medicine, and herd health for swine in the veterinary schools surveyed. Most preclinical subjects (such as microbiology, psychology, pathology, pharmacology, and epidemiology), which are less species-oriented, were not included in the survey. Similarly, for most schools, it was not possible to separate the amount of course/lab time assigned to swine for clinical pathology/postmortem examination.

Obviously, there are great differences between

Table 1—Time assigned to teaching swine medicine, surgery, theriogenology, preventive medicine and herd health in selected US and Canadian veterinary schools, 1987–1988

Schools of veterinary medicine	Lecture		Clinical Laboratories		Herd health/field work	
	Required	Elective	Required	Elective	Required	Elective
1. North Carolina	42 h	80 h	45 h	0	1 wk	2 wk
2. Iowa	75 h	45 h	13 h	16 h	4 days	4 days
3. Minnesota	44 h	48 h	8 h	0	2 days	1 wk
4. Indiana	35 h	16 h	3 h	1 wk	1 day	5 wk
5. Illinois	31 h	30 h	12 h	0	3 days	3 wk
6. Wisconsin	25 h	30 h	6 h	0	2 days	2 wk
7. Michigan	20 h	20 h	7 h	0	1 day	60 h
8. Missouri	15 h	17 h	15 h	0	10 h	8 h
9. New York	12 h	0	8 h	0	3 h	0
10. Texas	6 h	16 h	1 h	0	1 day	0
11. Guelph/Canada	39 h	0	5 h	0	1 wk	2 wk

the swine programs in the veterinary schools surveyed in the United States and Canada. Schools in states with small swine production apparently put less emphasis on teaching swine diseases, but there are also marked differences between schools in states where swine production is an important part of agriculture (Table 1). Is this consistent with the AVMA rules that American veterinary students are to be offered a sufficiently broad education to include all the important food animals species? I don't think it is.

In the European schools investigated, the number of required lectures on swine diseases varied from about 40 to 100 hours, and practical laboratory/field training from 100 to 200 hours. In addition, most of the schools had extensive courses in ethology, animal hygiene, postmortem examinations/clinical pathology and public health/meat hygiene, with considerable emphasis on swine. The only country emphasizing comprehensive elective courses in swine is Denmark, with 70 hours of lectures and 105 hours of laboratory/field electives required in addition to 100 core hours of lectures and 145 core hours of laboratory/field courses. In addition, 20 lectures and 20 laboratory hours of special pathology plus 10 lectures and 10 laboratory hours of anatomy and 65 lecture hours of meat hygiene are required. As a result, Denmark, where about 15 million hogs are produced each year, has established itself as a world leader of swine veterinary medicine, both in education and in many areas of disease research. An excellent example is the unparalleled success of the Danish national specific pathogen-free herd program. Other European countries follow Denmark on a smaller scale. In Sweden, required swine courses cover more than a month of lectures and laboratory/field courses. Public health/meat hygiene courses, which deal with swine to a considerable extent, cover almost a whole semester of course work. During the summer break between the fourth and fifth year, several students are offered 1- to 2-month assistantships at the national Swine Herd Health Scheme.

Does course time devoted to food animals mean less time devoted to companion animals?

Does more emphasis on swine (and other food animals) mean relatively less time on companion animal courses? The answer must be yes. Does this mean that companion animal veterinarians that graduate from Denmark, Sweden, or Iowa or North Carolina (Table 1), are unfit to work in small animal clinics? I think most would agree that they still can serve their clients well under normal circumstances, despite having received fewer hours of sophisticated specialty teaching, such as dentistry and oncology, compared with veterinarians graduated from small animal-oriented veterinary schools. This raises questions about how much in-depth specialization should be included in the general veterinary curriculum and how postgraduate programs should be organized for those who want to specialize.

My philosophy on teaching of swine medicine in the veterinary core curriculum

How many hours of lectures and clinical/field training are needed to cover the basics of swine medicine? Even though modern swine veterinary medicine is closely integrated with herd management, evaluation of production results, and economics, I believe it is important first to emphasize the basics of the important specific diseases and disease syndromes in the required lectures and clinical teaching such as etiology, prevalence, economic importance, clinical signs and lesions, pathogenesis, treatment, control, and prevention. How can we expect students to know where to start and end a problem-solving approach and analyze the intricate host-agent-environment relationship if they do not know which diseases exist within various organ systems, how they present themselves clinically and interact, and how they can be differentiated from each other?

How much time is needed to cover basics?

My list of swine disease conditions, familiar to every swine veterinary practitioner, includes about 70 infectious and noninfectious diseases, disease syndromes, and abnormalities. Of these, about 50 are important enough to be included in my wish-list for required basic subject matter. Roughly 15 minutes of information about each one of these diseases would total about 17 lecture hours. In addition, basic information about production variables, reproductive physiology, clinical management, the neonatal pig, and important environmental factors that are applied to herd health and epidemiology, would require another 10 to 15 hours. Thus, my minimum list would total 30 to 35 required core hours beyond what is shared between species in the preclinical course programs. Some of the schools investigated (Table 1) come fairly close to these figures.

Each European school surveyed and several of the American schools (No. 1 to 4, Table 1) assign large portions of diagnostic laboratory training of postmortem examinations and applied serology, microbiology, and pathology to the swine program. Diagnostic laboratory work is an essential backbone of swine medicine that cannot be overemphasized. One week of applied laboratory training is a minimum on my wish-list for the required core curriculum.

Field herd exposure is as essential for understanding and applying the concepts of flock/herd animal medicine, epidemiology, and herd health programs as the individual patient is to companion animal veterinary medicine. One herd or one sick animal is not enough to demonstrate the variety of disease expressions that exist. One week of daily herd visits is hardly enough to expose students to

the various herd health conditions that exist in the field, but of the schools investigated in the United States, only the University of North Carolina provides that much required field swine herd health work. In comparison, veterinary students in Sweden are required to visit a minimum of 30 swine farms for herd health work. Other European veterinary schools similarly emphasize herd exposure.

For species other than swine, the required course time of clinical rotations is much more extensive in the United States. For instance, at the University of Wisconsin, senior veterinary students have 2 days of swine clinics during 4 weeks of large animal medicine and 2 to 4 weeks of large animal surgery. A minimum of 8 to 10 weeks is required for small animal medicine and surgery. Required clinical rotations in anesthesiology and radiology add important course time to non-swine species. Required ambulatory rotations of 2 weeks in large animal, predominantly dairy practices in Wisconsin, do not change the non-swine clinical teaching pattern. However, in Wisconsin, almost half of the fourth year is available for elective courses and externships, which allows students to explore interests in swine or other fields of veterinary medicine. Most other veterinary schools in the United States have similar arrangements for species such as swine, poultry, and laboratory animals, or nonclinical disciplines in areas such as diagnostic medicine and toxicology, which are not covered by the required core curriculum.

I believe the following questions must be asked: Is it likely that specialty elective programs without core curriculum resources will receive enough school funds and faculty resources to make them meaningful? Is it likely that students with little or no required course exposure will choose elective courses in those fields? Can students justify electives for which they have little or no previous training?

Elective programs: Logical continuation of required core programs

I believe that a meaningful, quality elective program is the logical continuation of a quality core program. I believe that there is enough time for both required core courses and a good variety of quality elective courses during the third and fourth year of veterinary school if the required clinical teaching of all species is restricted to the basics, similar to my "mini-listing" of swine medicine core material. Thus, a broad background, which has been and still seems to be highly appreciated by most veterinarians, will survive with all the benefits previously mentioned, but also will allow students to branch into areas that might be lost without the support of other, stronger "mainstream" fields of veterinary medicine.

The role of veterinarians in whole-herd information-based services

Wise[3] reported that food animal producers give veterinarians excellent ratings for diagnostic and therapeutic skills, but low ratings for knowledge of nutrition, farm economy, and production analysis. Wise indicated that the low-rated areas have to be addressed to improve and expand food animal practices: "Fundamentals of whole herd information-based services must include expertise in subjects such as herd management, production analysis, nutrition, environmental analysis, epidemiology, agribusiness, financial analysis, and the use of computers."

I strongly support the concept of whole-herd information-based services being included in both the veterinary curriculum and, even more, in postgraduate food animal medicine programs; however, I am concerned about the above listing of skills in which epidemiology is the only subject directly related to veterinary medicine in its true sense. Has the crisis in food animal medicine led even veterinarians to believe that veterinary medicine is less important than the other professional areas mentioned in the survey? Is the goal for swine practitioners to become swine producers with a veterinary degree? Or are added degrees in animal science, agricultural engineering, agricultural economy, and business management required for success of a swine-oriented veterinary practice? Several swine veterinarians already have achieved such goals by postgraduate and continuing education, farm experience, and diligent hard practice work with the swine industry.[7,8,14] There should also be great job opportunities in the swine industry for young veterinarians who are motivated and willing to pay the high price of postgraduate education to achieve all these goals. However, I doubt that such an enormous package of education demands will solve the crisis for swine veterinary medicine and provide acceptable veterinary services to the approximately 85 million hogs produced annually in thousands of herds in the United States. First, students come to veterinary schools because of their genuine desire and motivation to work with biological sciences related to animals and their health problems. I see no future for any program in veterinary schools unless we keep those basic ideas in mind. Second, continuously sky-rocketing educational costs effectively limit the course time and content that can be put into the veterinary curriculum and graduate and postgraduate programs. Provocatively stated, if veterinary medicine is not as important to the swine industry as are animal science, agricultural engineering, and economy, it might be better to add courses on swine diseases and epidemiology to the educational programs of those professional groups and have them take the responsibility for applied herd health programs. Farm supply stores and catalogues could be the sole source of medicines, and veterinarians could restrict their involvement to diagnostic laboratory work and research.

There is a reality to such provocative statements. If statements, like "fieldmen post their own pigs,"[14] and "less emphasis should be placed on disease,

therapy and vaccination" and "swine practitioners need to become involved in sales training, cash flow analysis, system analysis, structural engineering and marketing schemes,"[15] are not being exaggerated to make a point, most of the content of the veterinary curriculum appears to be a waste of time and money for the swine specialist.

What to do

Swine veterinary medicine is at a crossroad in the United States, and everybody involved ought to think seriously about the issue and how it relates to them.

1) Veterinary educators need to address how to implement a reasonable adjustment to the veterinary core curriculum to make it worthwhile for students with an interest in swine to become swine practitioners, and how to develop quality elective courses and in-depth postgraduate programs focusing on areas that are important to the swine producers and to the health of the pigs and the veterinary profession.

2) Swine practitioners need to express their concerns and suggestions on how to adjust their profession to the changing livestock industry without losing their competitiveness or identity as veterinarians.

3) Veterinary diagnostiticians need to emphasize their fundamental role as the true source of expertise for analysis of the direct causes of diseases and health problems, which is essential for the follow-up analysis of the role of herd environmental and other factors to the disease.

4) Veterinary researchers at universities and in the pharmaceutical industry should be continually challenged and stimulated to work with swine health problems of real importance to swine production and, in turn, be better recognized as important participants in the swine veterinary team.

5) State and federally employed veterinarians working with swine disease investigations likewise need recognition for being a part of the swine veterinary team and for their vital contributions to the swine industry.

6) Swine producers have to decide how they want to use veterinary services. Without interesting job opportunities there will be no future for veterinarians in this field. Animal health problems do exist. Any swine practitioner knows that virtually every farm still has swine health problems and that all-in all-out production principles, barn partitions, and feed additives are directly related to control of diseases. Producers continue to express animal health concerns in the annual surveys conducted by NPPC. European experiences tell us that organized herd health schemes contribute to positive producer-veterinarian relationships. Perhaps this is the time to build on the prudent drug use program and establish a similar and more organized relationship between the organizations of swine producers (NPPC) and veterinarians (American Association of Swine Practitioners) to the benefit of both parties.

7) The consumers must also be involved in the issue. In Europe, the general public strongly supports food animal veterinary medicine in public health (meat inspection and food safety) and animal care ethics. What is the perception of food animal veterinarians among the American public? I believe that a survey of those perceptions would be important. At a time when drug residues and food animal welfare issues are being hotly debated, and when consumers are publicly advised to fry their breakfast eggs on both sides to avoid *Salmonella* infection, there is an opportunity and responsibility for veterinarians to take leadership roles for the protection of both animal and public health.

References

1. Proceedings of the ninth symposium on veterinary medical education. *J Vet Med Educ* 1987;14:34–99.
2. Schwabe CW. Utilization of food animals is a necessity and responsibility. *Calif Vet* 1988;42:13–20.
3. Wise JK. The US market for food animal veterinary medical services. Schaumburg, Ill: American Veterinary Medical Association, 1987;1–185.
4. Newham B. Vets have become more things to more people. *Pork '88* 1988;8 (7):4.
5. Vets focus on prudent drug use with on-farm visits (editorial). *Pork Report* 1988;7 (1):6.
6. Ruck D. Sulfa residue testing becomes a critical need. *Swine Pract* 1988;1:6–10.
7. BeVier GW. Swine consultation practice: a telephone and a computer modem. *J Am Vet Med Assoc* 1987;190:154–156.
8. Leman AD. Diagnosis and treatment of food animal educational diseases. *J Am Vet Med Assoc* 1988;193:1066–1067.
9. Wagner WC, BeVier GW, Dierks RE. Training in food animal management: Implications for veterinary curricula. *J Am Vet Med Assoc* 1988;193:46–49.
10. Dial G. AASP membership survey: characteristics and interests of the swine practitioner, in *Proceedings*. Am Assoc Swine Pract 1988;161–170.
11. Wilson MR. The need for swine health management specialty training. Kernkamp Lecture, in *Proceedings*. Swine Herd Health Prog Conf 1986;433–440.
12. Kitchen H. Essentials for the DVM degree: insuring flexibility. *J Vet Med Educ* 1987;14:92–94.
13. White ME. Let's stop loose talk about the "Information explosion." *J Vet Med Educ* 1988;15:25–26.
14. Wetzell TF. Thirty-two years of marketing large animal practice. *Anim Health Nutr Large Anim Vet* 1988;43:4:6–8.
15. Herrick JB. The future of large animal practice. *Anim Health Nutr Large Anim Vet* 1988;43:9–14.

Economic Note

1987 incomes of US Veterinarians

The American Veterinary Medical Association conducted an economic survey of US veterinarians in the spring of 1988. The purpose of the survey was to secure accurate data on veterinarians' earnings in private practice and in nonprivate practice employment. Findings from the survey, to be published in *JAVMA* in the coming months, should be useful because they provide information on veterinarians' incomes according to type of employment, years of experience, and other important characteristics. In addition, valuable national data will be provided on economic returns to private veterinary practice, staff numbers, cash operating expenses, and other practice characteristics.

Survey method and sample size

The sample of veterinarians was selected randomly from AVMA's computerized records of 40,190 nonretired member and nonmember veterinarians. In the private practice sector, survey questionnaires were mailed to 1,000 veterinarians in each of 6 categories of private practice: large animal exclusive, large animal predominant, mixed animal (50% large, 50% small), small animal predominant, small animal exclusive, and equine. The large animal exclusive group included veterinarians engaged in bovine, porcine, and poultry practice, but not equine practice. Each group was sampled equally to ensure statistically reliable estimates for each type and to permit analysis within each group. The survey also included 1,000 randomly selected veterinarians employed in private practice, but who were not classifiable according to the aforementioned 6 types of private practice.

In the nonprivate practice sector, questionnaires were mailed to 500 veterinarians in each of 4 nonprivate practice categories: college or university, federal government, state or local government, and industry or other employers. Surveys also were mailed to all 491 armed forces veterinarians listed in AVMA records as residing in the United States. The total survey sample consisted of 9,491 US veterinarians (Table 1).

An advance letter was mailed to all veterinarians in the sample on Mar 18, 1988, alerting them that they would soon receive the biennial economic survey. The questionnaire was mailed on March 24 and was followed by 2 mailings of reminder postcards. When the survey was terminated (May 20), 4,350 (46%) questionnaires had been returned to the AVMA. The sample of respondents was determined to be representative of the US veterinary medical population with respect to geographic, sex, and age distributions.

The survey questionnaire was identical to the one used for the 1986 AVMA biennial economic survey.[1] Section 1 was completed by all veterinarians in private and nonprivate practice

Table 1—1988 biennial economic survey sample

	No. of veterinarians in population	No. of veterinarians in sample	No. of respondents	Percentage response
Veterinarians in private practice				
Large animal exclusive	1,584	1,000	207	21
Large animal predominant	4,463	1,000	346	35
Mixed animal	3,121	1,000	360	36
Small animal predominant	4,744	1,000	517	52
Small animal exclusive	17,049	1,000	734	73
Equine	1,585	1,000	311	31
Other types	1,122	1,000	79	8
All practice types	33,668	7,000	2,554	38
Veterinarians not in private practice				
College or university	4,157	500	300	60
Federal government	1,487	500	325	65
State or local government	842	500	288	58
Armed forces	491	491	275	56
Industry or other	2,655	500	608	122
All employer types	9,632	2,491	1,798	72
Total veterinarians	43,300	9,491	4,350	46

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Table 2—Mean incomes of veterinarians in private practice, 1987

Type of practice	Mean income ($)	Median income ($)	No. of respondents
Large animal exclusive	56,464	48,250	153
Large animal predominant	49,384	41,928	290
Mixed animal	45,434	34,900	296
Small animal predominant	50,608	37,900	411
Small animal exclusive	54,118	39,700	529
Equine predominant	60,653	40,480	228
All practice types	52,643*	39,793*	1,907

*Weighted estimates based on total population of 33,668 veterinarians in private practice.

and included questions on individuals' 1987 incomes, type of practice or employment, years of experience, age, sex, fringe benefits, hours and weeks worked, practice ownership status, and share of capital investment in practice real estate and equipment. Section 2 was completed only by veterinarians who were private practice owners, ie, sole proprietors, partners, or shareholders in private veterinary practices. Information was provided on type of practice, facility and organizational form, assets and liabilities, market and community size, 1987 gross practice income, and 1987 operating expenses.

Income analysis

Veterinarians indicated their 1987 individual income, before personal taxes, from professional veterinary medical activity, including income from practice, salary, profit sharing, and bonuses. If the respondent was the owner of a veterinary practice, the owner's return from capital invested (ie, practice real estate) was included as income, even if leased by the owner to the practice.

Respondents reported individual net incomes at $3,000 increments ranging from "less than $16,000" to "$76,000 or more." Responses from veterinary practice owners were reviewed in detail to obtain valid estimates of net practice income. Specifically, reported individual net income of owners was compared with computations made on the owner-respondent's practice income and expense data. For this analysis, individual private practice net income included return on capital invested, labor, and management. In other words, practice owners' return on practice investment has not been deducted from income. A future report will focus on this measure of practice owner income.

Mean income was calculated by summing all income values and dividing by the number of respondents. Median income was calculated (based on interval midpoints) as the income level that divided the income distribution in half, ie, 50% of all veterinarians earning incomes below and 50% above this income level. Respondents were included in this analysis if they worked on the average at least 30 hours/week, and at least 48 weeks in their reported type of practice or employment in 1987.

Veterinarians in private practice

The 1987 mean individual net income, before personal taxes, of US veterinarians in private practice was $52,643 (Table 2). Mean income for specific types of private practice ranged from lows of $45,434 for mixed animal practitioners and $49,384 for large animal predominant practitioners to a high of $60,653 for equine practitioners. Mean income for large animal exclusive practitioners was $56,464, and for small animal predominant and small animal exclusive practitioners, income was $50,608 and $54,118, respectively.

The 1987 median individual net income of US veterinarians in private practice was $39,793. The median incomes ranged from $34,900 for mixed animal practice to $48,250 for large animal exclusive practice. In every type of practice, the median income was less than the mean income. This difference highlights the fact that few very high incomes offset many lower incomes to yield a mean higher than the median.

A comparison of mean incomes for 1985 and 1987 showed that private practice income increased 9.5% or about 4.7%/year. Large animal exclusive practitioners showed the greatest percentage increase (29.8%) over the 2-year period. Percentage increases from 1985 to 1987 for other practice types were as follows: large animal predominant,

Table 3—Percentage distribution of veterinarians in private practice, by income classes, 1987

Income class ($)	Large animal exclusive	Large animal predominant	Mixed animal	Small animal predominant	Small animal exclusive	Equine
Less than 25,000	9.9	13.1	21.0	21.0	15.5	17.2
25,000 to 36,999	24.4	26.6	30.0	25.5	29.4	25.3
37,000 to 48,999	14.4	19.0	11.9	16.3	14.2	15.8
49,000 to 60,999	12.5	17.3	13.7	9.3	11.7	10.1
61,000 to 72,999	14.5	9.6	10.5	8.8	8.1	7.4
73,000 to 84,999	9.2	6.8	4.1	6.5	5.2	5.3
85,000 to 96,999	3.3	2.7	3.8	5.8	3.2	4.4
97,000 or more	11.8	5.1	5.0	8.0	12.7	14.4
	100 (153)*	100 (290)	100 (296)	100 (411)	100 (529)	100 (228)

*Number of usable responses in parentheses.

Table 4—Mean incomes of veterinarians not in private practice, 1987

Type of employer	Mean income ($)	Median income ($)	No. of respondents
College or university	50,739	49,000	246
Federal government	45,477	42,000	240
State or local government	45,500	42,786	247
Armed forces	43,365	40,409	238
Industry/commercial	65,321	58,000	149
Other/not-for-profit organizations	51,747	43,000	89
All employer types	51,995*	48,182*	1,209

*Weighted estimates based on population of 9,632 veterinarians in private practice.

4%; mixed animal, 4.9%; small animal predominant, 6.8%; small animal exclusive, 10.2%; and equine predominant, 8.3%.

Interestingly, in 1985, large animal exclusive practitioners had lower incomes, on average, than other types of practitioners and suffered a 6.1% decrease from 1983 to 1985.[1]

For each type of private practice, percentages of veterinarians were determined for income classes ranging from less than $25,000 to more than $97,000 (Table 3). Each income class represented an income interval of $12,000. Comparisons of percentages of veterinarians in particular income classes indicated greater income variation in some types of practices than in others. For example, at least 11% of large animal exclusive, small animal exclusive, and equine practitioners earned more than $97,000 in 1987, compared with only 5% of large animal predominant and mixed animal practitioners who earned at least that amount. Twenty-one percent of mixed animal and small animal predominant practitioners earned less than $25,000, compared with 9.9% of large animal exclusive practitioners.

Veterinarians not in private practice

The 1987 mean income of US veterinarians not in private practice was $51,995 (Table 4). Mean incomes for specific types of nonprivate practice ranged from a low of $43,365 for armed forces veterinarians to a high of $65,321 for veterinarians in industry. Mean incomes for other nonprivate practice types were $45,477 for federal government, $45,500 for state or local government, $50,739 for college or university, and $51,747 for other/not-for-profit organizations.

The 1987 median individual income of US veterinarians not in private practice was $48,182. The median incomes ranged from a low of $40,409 for armed forces to a high of $58,000 for industry. A comparison of the mean and median incomes indicated that the difference between them was small, which suggests there were relatively few high incomes.

A comparison with 1985 incomes showed that mean nonprivate practice incomes increased 10% over the 2-year period. With the exception of other/not-for-profit organizations, where the mean income declined 3.3%, mean incomes for each nonprivate practice type increased from 1985 to 1987. Mean incomes increased as follows: college or university, 16.4%; federal government, 5%; state or local government, 12.2%; armed forces, 4%; industry/commercial, 4.4% (Table 5).

Reliability of 1987 income estimates

Estimates of veterinarians' incomes derived from sample surveys are subject to sampling errors that arise because observations are made on only a portion of the total population. To make statistical inferences about true population mean incomes, it is useful to determine confidence intervals.

A confidence interval is a range of values that has a predetermined probability of including the true population mean income. For example, it may be stated that there is a 95% probability that the estimated mean income plus or minus 2 SE will encompass the true, but unknown, population mean income.

Confidence intervals of the true mean incomes in 1987 for all private and nonprivate practice types were determined (Table 6). For all private practitioners, one can be 95% confident that the interval $50,963 to $54,323

Table 5—Percentage distribution of veterinarians not in private practice, by income classes, 1987

Income class ($)	College or university	Federal government	State or local government	Armed forces	Industry/ commercial	Other/ Not-for-profit
Less than 25,000	12.8	1.4	2.0	4.2	2.8	18.0
25,000 to 36,999	8.6	26.4	24.8	26.9	11.7	19.1
37,000 to 48,999	26.7	40.1	41.1	38.6	18.9	19.3
49,000 to 60,999	23.1	18.4	19.9	20.2	18.6	15.7
61,000 to 72,999	17.7	10.4	9.7	10.1	16.5	10.1
73,000 to 84,999	5.4	2.5	1.2	...	11.0	5.6
85,000 to 96,999	2.9	0.4	0.8	...	6.2	3.3
97,000 or more	2.8	0.4	0.4	...	14.5	8.9
	100 (246)*	100 (240)	100 (247)	100 (238)	100 (149)	100 (89)

*Number of usable responses in parentheses.

Table 6—Mean income confidence intervals for US veterinarians, 1987

	Estimated mean income ($)	se of estimated mean income ($)	95% confidence interval of true mean income ($)*
Veterinarians in private practice			
Large animal exclusive	56,464	2,610	51,349≤μ≤61,579
Large animal predominant	49,384	1,642	46,166≤μ≤52,609
Mixed animal	45,434	1,683	42,138≤μ≤48,732
Small animal predominant	50,618	1,757	47,174≤μ≤54,062
Small animal exclusive	54,118	1,747	50,694≤μ≤57,542
Equine	60,653	4,007	52,800≤μ≤68,506
All practice types	52,643	857	50,963≤μ≤54,323
Veterinarians not in private practice			
College or university	50,739	1,348	48,097≤μ≤53,381
Federal government	45,477	871	43,770≤μ≤47,184
State or local government	45,500	788	43,955≤μ≤47,044
Armed forces	43,365	764	41,868≤μ≤44,862
Industry/commercial	65,321	2,571	60,282≤μ≤70,360
Other/not-for-profit organization	51,747	3,641	44,611≤μ≤58,883
All employer types	51,995	627	50,766≤μ≤53,224

*Form of confidence interval is $(\bar{x} - t\sigma_{\bar{x}}) \leq \mu \leq (\bar{x} + t\sigma_{\bar{x}})$ where $\bar{x}$ is mean income, t is 1.96, $\sigma_{\bar{x}}$ is se of the mean income, and μ is the true mean income.

will encompass the true 1987 mean income. Because of the smaller samples sizes in each of the 6 private practices and 6 nonprivate practice types, 95% confidence intervals are greater, ranging from $3,000 to $12,000.

Because a mean income estimate is influenced by extreme values at the high end of an income distribution, the median estimate often is considered a more meaningful estimate of the central income level of a population.

Reference

1. Wise JK. 1985 incomes of US veterinarians. *J Am Vet Med Assoc* 1987; 190:1333–1336.